

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)


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CORRECTED VERSION

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| Applicant's or agent's file reference TS 1168 PCT | FOR FURTHER ACTION See Form PCT/IPEA416 | |
| International application No. PCT/EP 03/03244 | International filing date (day/month/year) 27.03.2003 | Priority date (day/month/year) 27.03.2002 |
| International Patent Classification (IPC) or national classification and IPC C10B21/00 | | |
| Applicant SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V. | | |
| <p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 4 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (Article 16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority has approved as an amendment that goes beyond the disclosure in the international application as filed, as indicated in the Supplemental Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> | | |
| <p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p> | | |
| Date of submission of the demand 24.10.2003 | Date of completion of this report 22.09.2004 | |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized Officer Buesing, G Telephone No. +49 89 2399-8356 | |



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP 03/03244

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-3, 5-7 as originally filed
4, 4a received on 23.04.2004 with letter of 23.04.2004

Claims, Numbers

1-11 received on 23.04.2004 with letter of 23.04.2004

Drawings, Sheets

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP 03/03244

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|-------------|------|
| Novelty (N) | Yes: Claims | 1-11 |
| | No: Claims | |
| Inventive step (IS) | Yes: Claims | 1-10 |
| | No: Claims | 11 |
| Industrial applicability (IA) | Yes: Claims | 1-11 |
| | No: Claims | |

2. Citations and explanations (Rule 70.7):

see separate sheet

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**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/EP 03/03244

This report supersedes the previously issued report dated 28.05.2004

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The invention aims at a reduction of hydrothermal deactivation of FCC catalysts during regeneration. This problem is solved by the essential steps of cooling the combustion gas to below the dew point of water in the gas and the separation of the water before the gas is used in the regeneration process.

There is no prior art available which anticipates or makes obvious such a process. Claim 1 therefore defines an inventive process. The same applies for the independent method claim 10.

2. The independent apparatus claim 11 does not define all the constructive features which are necessary for carrying out the inventive process. It is noted that claim 11 merely defines a gas transport unit with a cooling unit upstream of the reactor but does not require means for separating condensed water. The apparatus according to claim 11 is therefore not suitable for solving the problem. Hence, no inventive activity can be acknowledged.
3. It is noted that the word "by" is obviously missing between "coke" and "means" in line 5 of claim 1. Further, the word "catalyst" after "FCC" in page 1, line 2, is also missing.

regeneration unit and combusting the coke by means of the oxygen-containing gas, characterized in that the oxygen-containing gas is cooled in a cooling unit (8) to a temperature below the dew point of water present in the gas thereby giving condensation of water, wherein the condensed water is separated from the gas before it is brought in contact with the coke-containing FCC catalyst.

The cooling unit allows the gas transport unit to transport more gas in terms of weight to the regeneration unit increasing the capacity of the regeneration process. Adding a cooling step to an existing FCC regenerator process is thus a method to increase the capacity of such an unit.

Cooling furthermore lowers the dew point of water present in the gas, thereby giving condensation of water. This condensed water is suitably separated from the gas before the gas is used in the regenerator process. The oxygen-containing gas therefore contains less water than non-cooled gas. It was found that this was very beneficial for the average lifetime of the catalyst, since less catalyst was irreversibly destroyed by hydrothermal deactivation of the (zeolite) catalyst at the high temperatures (typically around 680 °C) that are used in the regeneration process. Reduction of moisture in the oxygen-containing gas, for instance, from 2.8 wt% to 0.8 wt% or less is easily obtainable with the present process.

From a practical standpoint it is preferred that the oxygen-containing gas is cooled before or during its stay in the gas transport unit. More preferably the oxygen-containing gas is cooled before its stay in the gas transport unit.

- 4a -

The oxygen-containing gas may be any gas that contains oxygen, and most preferably such oxygen-containing gas is air.